Accuracy and Safety of Pedicle Screw Placement in Adolescent Idiopathic Scoliosis Patients

A Review of 2020 Screws Using Computed Tomography Assessment

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Study Design. Retrospective review of CT scan.
Objective. To investigate the accuracy and safety of pedicle screws placed in adolescent idiopathic scoliosis (AIS) patients.

Summary of Background Data. The reported pedicle screws perforation rates for corrective AIS surgery vary widely from 1.3% to 65.0%. Knowledge regarding the safety of pedicle screws in scoliosis surgery is very important in preventing complications.

Methods. This study investigated the accuracy and safety of pedicle screws placed in 140 AIS patients. CT scans were used to assess the perforations that were classified according to Rao et al (2002): grade 0, grade 1 (<2 mm), grade 2 (2-4 mm), and grade 3 (>4 mm). Anterior perforations were classified into grade 0, grade 1 (<4 mm), grade 2 (4-6 mm), and grade 3 (>6 mm). Grades 2 and 3 (excluding lateral grade 2 and 3 perforation over thoracic vertebrae) were considered as critical perforations.

Results. A total of 2020 pedicle screws from 140 patients were analyzed. The overall total perforation rate was 20.3% (410 screws with 8.2% (166 screws) grade 1, 2.9% (56 screws) grade 2 and 9.2% (166 screws) grade 3 perforations. Majority of the perforations was because of lateral perforation occurring over the thoracic region, as a result of application of extra-pedicular screws at this region. When the lateral perforations of the thoracic region were excluded, the perforation rate was 6.4% (129 screws), grade 2, 1.4% (28 screws) and grade 3, 0.9% (16 screws).

Pediculate screws are widely used for scoliosis correction surgery. Pediculate screw constructs have been shown to achieve better correction compared to older techniques. However, it is not without any risk of complications. Neurological deficits have been reported to occur after misplaced pedicle screws in scoliosis. Transect neurological deficit because epidural hematomas has also been reported. Delayed neurological presentation can occur because of medially misplaced screws. Pulmonary complications are also known complications. Vascular complications such as false aneurysms, intravenous thoracic aortic injury requiring endovascular treatment, and delayed presentation of aortic injury or perforation had been reported. Therefore, the knowledge on safety of pedicle screw placement is very crucial.

The pedicle screw perforation rates for scoliosis surgery vary widely from 1.2% to 65.0%. These studies can be (i) radiographic studies that used mainly plain radiographs to screen for perforations or (ii) CT scan studies that evaluated all screws. Plain radiographic studies had very low perforation rates, ranging from 1.2% to 3.0%.